AD-A052 437 CINCINNATI ELECTRONICS CORP OHIO F/G 17/2
VEHICULAR INTERCOMMUNICATION SYSTEM.(U)
MAR 78 C F WEDAMAN DAAB07-77-C-0190

UNCLASSIFIED ECOM-77-0190-1 NL

| OF |

AD
A052437

END
DATE
FILMED
5-78
DDC

(12)

Research and Development Technical Report
ECOM- 77-0190-1

VEHICULAR INTERCOMMUNICATION SYSTEM

PREPARED BY

C. F. WEDAMAN
CINCINNATI ELECTRONICS CORPORATION
2630 GLENDALE-MILFORD ROAD
CINCINNATI OH 45241

MARCH 1978

FIRST QUARTERLY REPORT FOR PERIOD 30 SEPT 1977 - 30 DEC 1977

DISTRIBUTION STATEMENT

APPROVED FOR PUBLIC RELEASE, DISTRIBUTION UNLIMITED

PREPARED FOR

PROJECT MANAGER SINCGARS
ATTN: DRCPM-GARS-LM
FORT MONMOUTH NJ 07703

US ARMY COMMUNICATIONS RESEARCH AND DEVELOPMENT COMMAND
ATTN: DRDCO-COM-RN-3, FORT MONMOUTH NJ 07703

NOTICES

Disclaimers

The findings in this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

The citation of trade names and names of manufacturers in this report is not to be construed as official Government indorsement or approval of commercial products or services referenced herein.

Disposition

Destroy this report when it is no longer needed. Do not return it to the originator.

(9) Quarterly rept. no. 1, 30 Sep-30 Dec 77,

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

(19) REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER
(18) ECOM-77-Ø19Ø-1

2. GOVT ACCESSION NO.

3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle)
(6) Vehicular Intercommunication System.

5. TYPE OF REPORT & PERIOD COVERED
First Quarter Report
30 Sep 77 to 30 Dec 77

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s)
(10) C. F. Wedaman

8. CONTRACT OR GRANT NUMBER(s)
(15) DAABØ7-77-C-Ø19Ø

9. PERFORMING ORGANIZATION NAME AND ADDRESS
Cincinnati Electronics Corporation
2630 Glendale-Milford Rd.
Cincinnati, Ohio 45241

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
694365.437.80.03.01

11. CONTROLLING OFFICE NAME AND ADDRESS
Project Manager, SINCGARS
ATTN: DRCPM-GARS-LM
Ft. Monmouth, NJ 07703

12. REPORT DATE
(11) Mar[redacted]978

13. NUMBER OF PAGES
26 (12) 30P.

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)
Commander
US Army Communications Research & Development Command
ATTN: DRDCO-COM-RN-3
Ft. Monmouth, NJ 07703

15. SECURITY CLASS. (of this report)
Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)
Approved for Public Release, Distribution Unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)
Vehicular Intercom, Wireless Intercom, Voice Signal Multiplexing, Inductive Radiators

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
This is the first quarterly report for the design study of a vehicular intercommunication system primarily used in tracked vehicles. The report covers the time period from 30 Sep through 30 Dec 77. Accomplishments for the period include preliminary tradeoff studies of multiplex systems for signal routing and analysis of inductive radiators for wireless audio accessories.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

407 944

JOB

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

SECTION I

INTRODUCTION

This is the first Vehicular Intercom System Study Quarterly Report and covers technical progress from the date of contract award on 30 September 1977 to 30 December 1977.

SECTION II

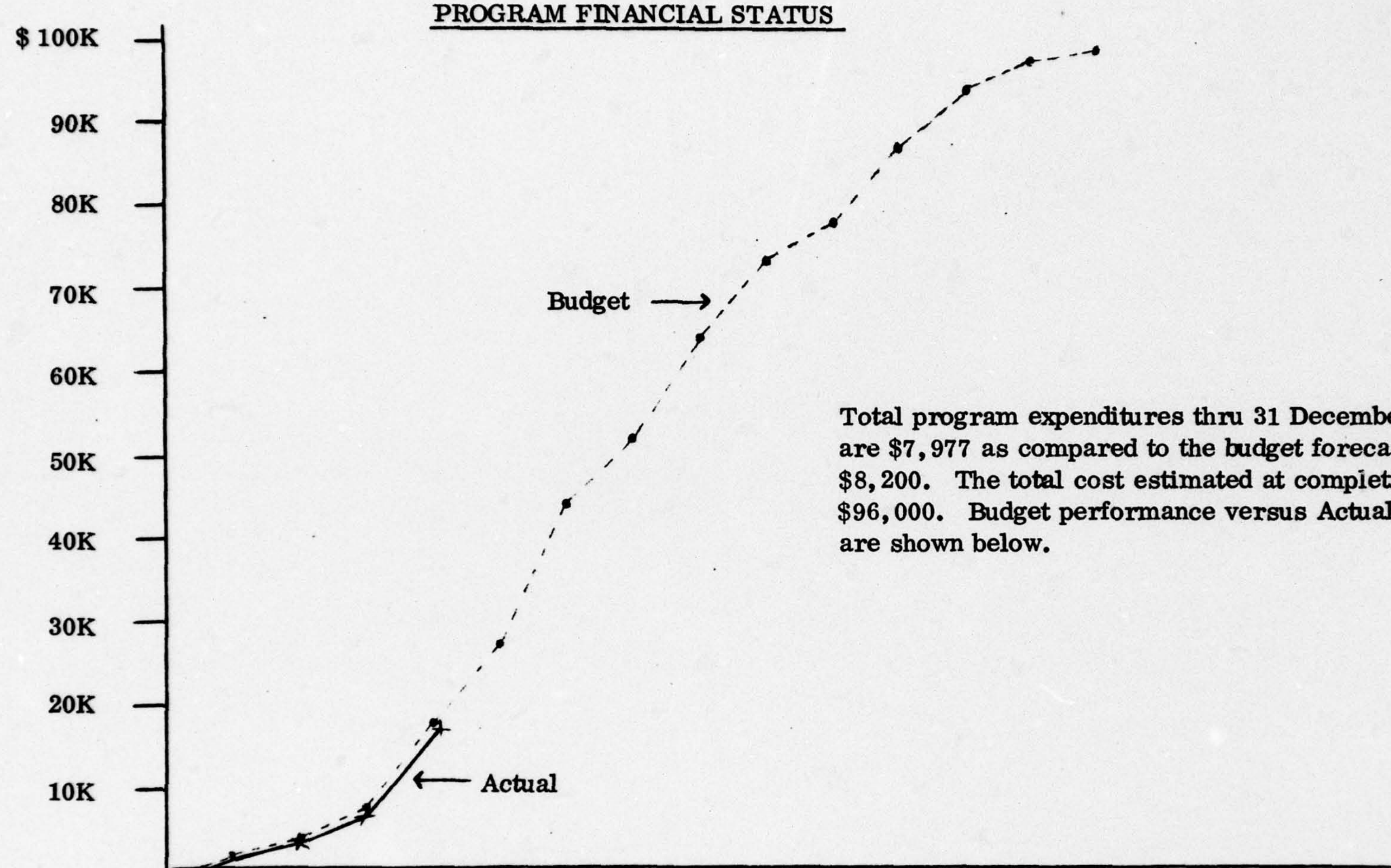
CONTRACT DELIVERY SCHEDULE

	1977			1978											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CLIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0002 Technical Data Exhibit A															
A001 Quarterly Reports			D△ #1	G△	F△ D*	D△ #2	G△	F△	D△ #3	G△	F△				
A002 Final Report												D△	G△	F△	
A003 LSA Plan															
- Conference	△														
- Plan		D△	G△ D*	F△											
A004 LSA Model						D△		G△				F△			
0003 Technical Data Exhibit B															
B001 Design Plan												D△	G△	F△	
B002 Specifications												D△	G△	F△	
0004 Technical Data Exhibit C															
C001 Contract Fund Status				△#1			△#2			△#3			△#4		

△ = Schedule   * = Actual

SECTION III

PROGRAM FINANCIAL STATUS



Total program expenditures thru 31 December 1977 are $7,977 as compared to the budget forecast of $8,200. The total cost estimated at completion is $96,000. Budget performance versus Actual costs are shown below.

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Budget $K	1.1	1.6	5.5	9.0	12.0	14.0	12.0	7.0	5.0	5.0	6.0	9.0	7.0	1.0	1.0
Actual $K	1.0	1.5	5.4												

SECTION IV

RESULTS OF STUDIES

This report represents progress of work performed in connection with

~~A. GENERAL~~

for audio signal detection equipment: for

Cincinnati Electronics' proposal ~~presented~~ three means of reducing vehicle cable wiring: frequency division multiplexing, time division multiplexing and a totally wireless scheme. ~~Progress to date of each of these is presented in this section.~~

In addition to multiplexing, Cincinnati Electronics is studying means of achieving wireless audio accessories.

B. MULTIPLEX SYSTEMS

1. Frequency Division Multiplexing (Figure 4-1) - Monitor Audio Processing

Each VIS crewmember has the possibility of monitoring five audio signals: intercom only, intercom and RT1, RT2, or RT3-Aux, and "All". In the proposed FDM system, each of these five sources is translated to a unique segment of the frequency domain at the central control box. The five audio signals are transmitted from the central over five separate carriers on a single wire, to each crewmember. The passband of each channel is chosen to be wide enough to pass the desired audio with minimum distortion, while sufficient space is allocated between "channels" to minimize crosstalk. In this manner simultaneous, non-interfacing communications can occur over a common transmission medium. At the crewmember junction box, the desired audio signal is demodulated to audio by demultiplexing the selected FMD carrier.

In the proposed design, received audio from an auxiliary receiver or receiver-transmitter is cabled to an Intercom Control Box (see Figure 4-1). In the control box, the audio modulates a Voltage Controlled Oscillator (VCO) whose free-running frequency is typically set between 20 and 100 kHz. Each receiver and the combination of each receiver called "ALL", as well as intercom audio, has a respective VCO set at a different frequency. This frequency division scheme allows all of the received and intercom audios to be cabled to station boxes with only one conductor. At each station box, the crewmember selects which audio he desires to hear. This selection forces his phase locked loop receiver to lock up on the desired VCO frequency. The PLL then demodulates the VCO frequency to obtain the desired audio.

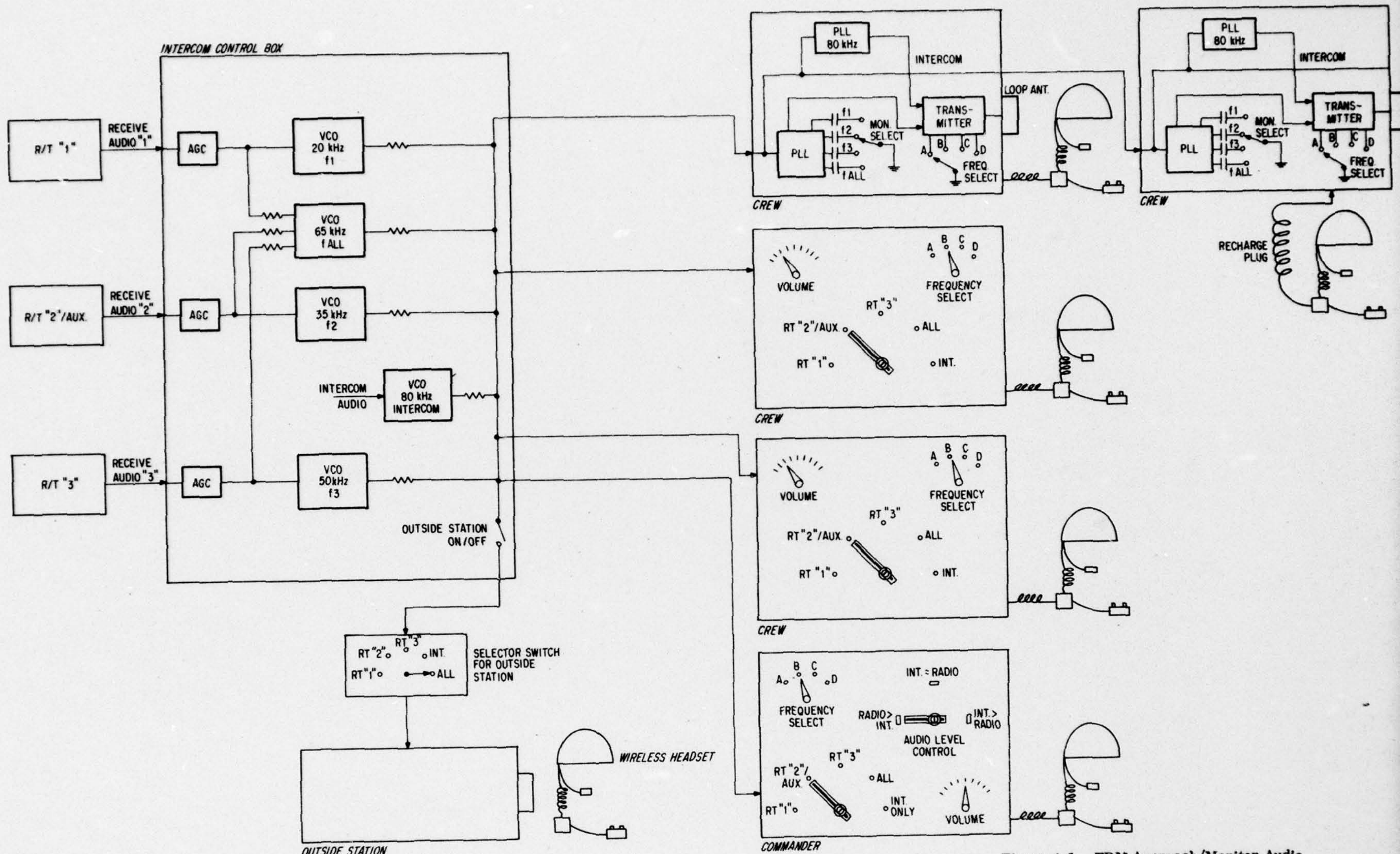


Figure 4-1. FDM Approach/Monitor Audio

1.1 Study Results and Progress - Monitor Audio System

LM565 and LM566 phase lock loops and voltage controlled oscillators in integrated circuit packages were ordered and received in early January 1978. Fabrication of a breadboard model using these integrated circuits is in process. Sufficient information should be extracted from the breadboard design by the next quarterly report to present trade-offs, problems and design criteria for this area of the FDM approach.

1.2 Mic Audio Processing

Microphone audios are routed different from monitor audio (see Figure 4-2). Each crewmember has a quad-bilateral, solid state switch located in the control box. His selector switch, located at this station, outputs a logic signal which is conducted via a cable conductor to his quad-switch. The crewmember's audio is AC-coupled to his logic conductor and also AC-coupled to his quad-switch. The logic signal (a DC level between 5 and 18 volts) activates the proper switch to route his microphone audio to a transmitter or to an intercom. Thus, only one conductor is needed in the cable to carry control signals as well as microphone audio.

1.3 Study Results and Progress - Mic Audio Processing

A feasible circuit for obtaining logic activation and audio switching, as mentioned in the introduction, is shown in Figure 4-3. In the control box, a zener diode regulates and filters input power. When a radio PTT occurs, transistor Q1 turns on which applies voltage to resistor string R4, R3, R2 and R1. Switch S1 selects different voltage points along the resistor string. These DC voltage levels correspond to the desired transmitter the crewmember wishes to transmit on. This voltage is placed on a wire. On top of this voltage audio signals from the crewmember's preamp is placed also. If an intercom PTT occurs, a preset voltage is placed on the wire. This voltage is isolated from the resistor string by diodes CR4 and CR3. Resistor R12 and capacitor C2 prevent audio from interfering with the resistor string or Q1 and Q2 operation.

Audio and DC level is conducted via a cable wire to the intercom control box. In the intercom control box, the DC level is compared to a level generated by a zener and resistor string. LM139 integrated circuit outputs a high logic level is the incoming voltage is higher than the reference. Transistors Q3, Q4, and Q5 will allow only one of the four outputs of LM139 to go high; and, thus, only one transmitter could be selected. The CD4066B, when properly biased, will allow audio signals to pass through when the gate voltage is high and stop audio when the gate voltage is low. This device routes mic audio to the proper transmitter or intercom. Transistors Q6, Q7, and Q8 operate relays which provide a ground closure to "key" a transmitter. All crewmember matrices will access the PTT relays via isolation diodes such as CR13, CR14, and CR15.

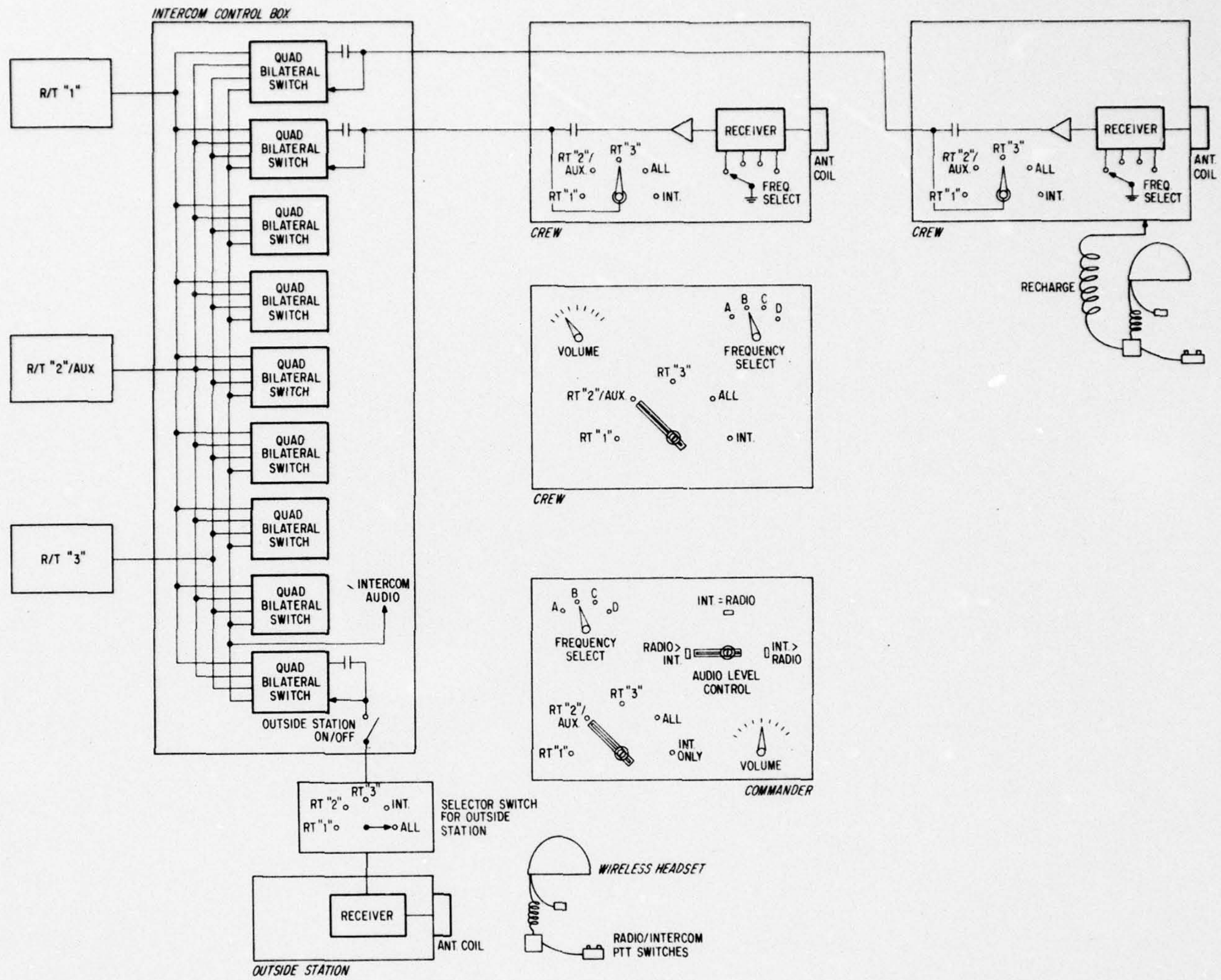
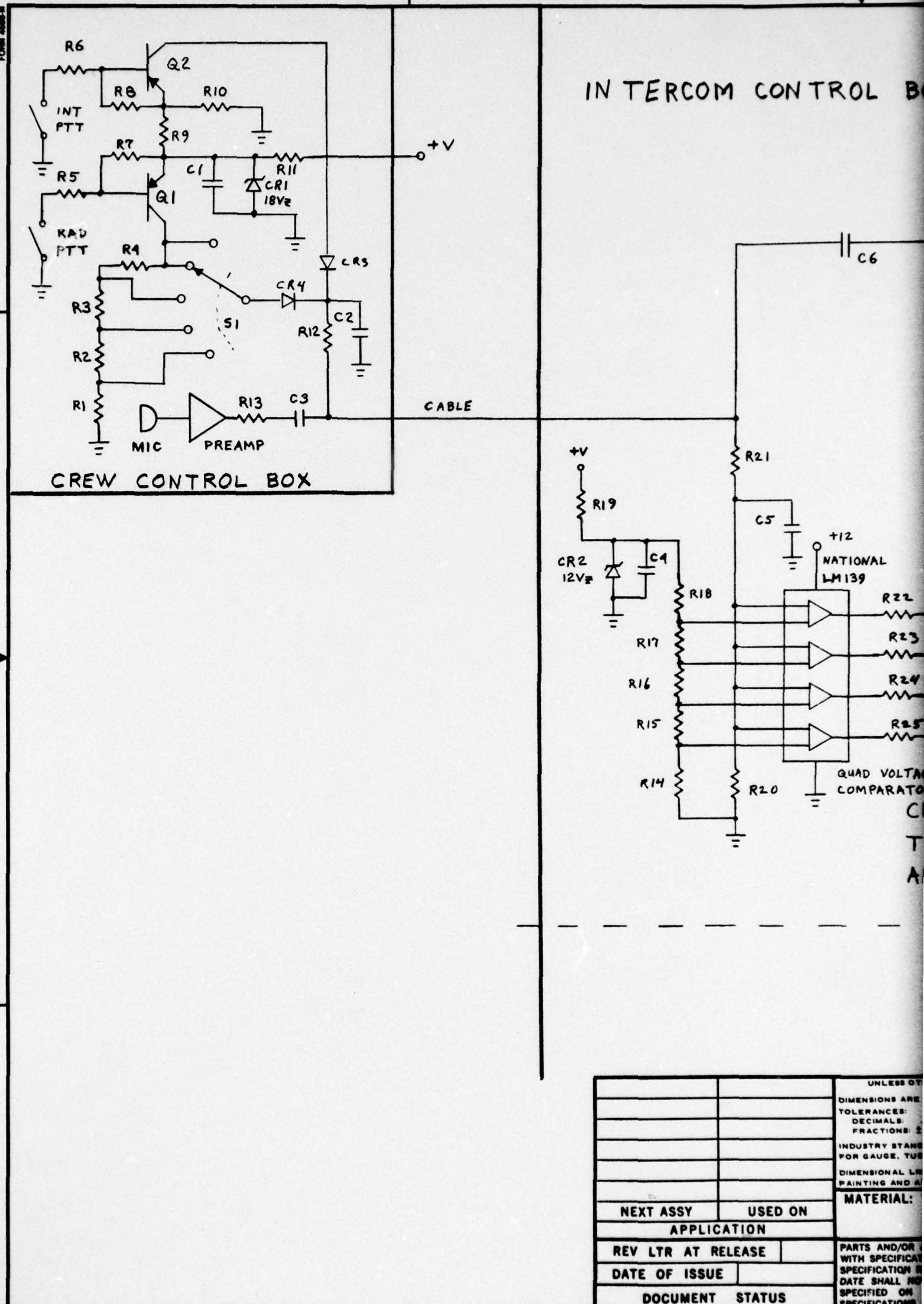


Figure 4-2. FDM Approach Microphone Audio



INTERCOM CONTROL B
CREW CONTROL BOX
R6
Q2
R8
R10
INT PTT
R7
R9
+V
R5
C1
CR1 18Vz
R11
Q1
RAD PTT
R4
CR5
CR4
R3
S1
C2
R12
R2
R1
MIC
PREAMP
R13
C3
CABLE
C6
R21
+V
R19
C5
+12
NATIONAL LM139
CR2 12Vz
C4
R18
R22
R17
R23
R16
R24
R15
R25
R14
R20
QUAD VOLTA
COMPARATO
NEXT ASSY
USED ON
APPLICATION
REV LTR AT RELEASE
DATE OF ISSUE
DOCUMENT STATUS
MATERIAL:

3 2 1

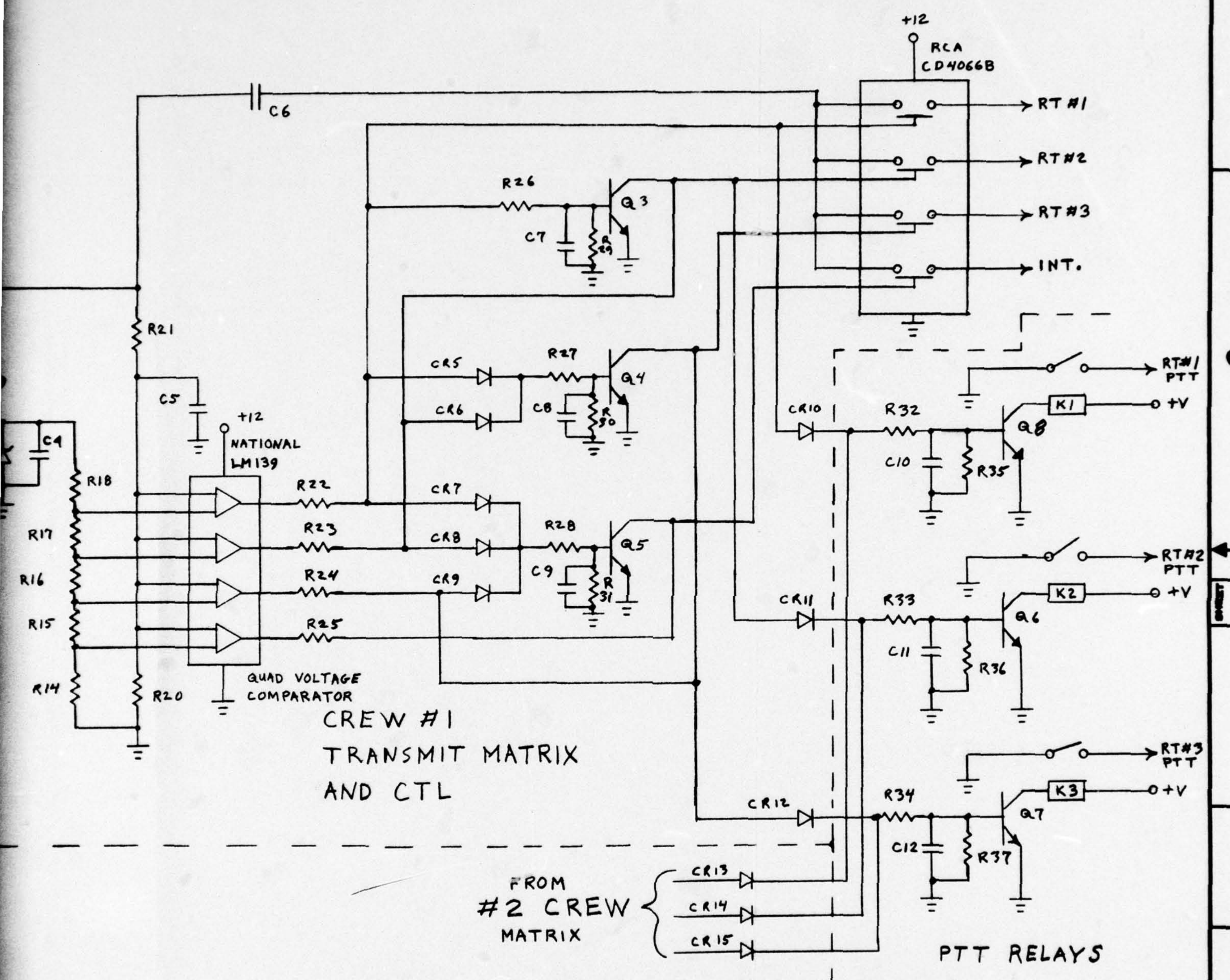
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

2

TERCOM CONTROL BOX

D

C



A

NEXT ASSY	USED ON
APPLICATION	
REV LTR AT RELEASE	
DATE OF ISSUE	
DOCUMENT STATUS	

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
DECIMALS: .XX ± .02 .XXX ± .005
FRACTIONS: ± 1/64 ANGLES: ± 1/2°
INDUSTRY STANDARD TOLERANCES APPLY FOR GAUGE, TUBING, AND BAR STOCK.
DIMENSIONAL LIMITS APPLY BEFORE PAINTING AND AFTER PLATING.

MATERIAL:

PARTS AND/OR ASSEMBLIES MUST COMPLY WITH SPECIFICATION(S) NOTED HEREON. THE SPECIFICATION REVISION LETTER AND ISSUE DATE SHALL NOT BE EARLIER THAN THAT SPECIFIED ON EITHER THE APPLICABLE SPECIFICATIONS LIST OR PURCHASE ORDER.

CONTRACT NO.

DRAWN	DKP	DATE 1-13-77
CHECKED		DATE
APPROVED		DATE

CE CINCINNATI ELECTRONICS CINCINNATI, OHIO

TRANSMIT FDM AUDIO

Figure 4-3

SIZE	CODE IDENT NO.	
C	80045	
SCALE		SHEET

1.4 RCA CD4066B

The quad-bilateral solid state switch, CD4066B, is a crucial part of the mic audio system since it blocks a crewmember's audio from one transmitter but allows his audio on another. Thus, this is a TEMPEST protection device as well as a mic audio routing device. CD4066's are presently used on a Marine intercom contract. Data taken on a system breadboard indicate these devices will meet Naval TEMPEST requirements. Unfortunately, this numerical data cannot be presented in this report without classification problems. If additional information is desired, a meeting can be arranged at Cincinnati Electronics or Fort Monmouth.

1.5 Probability of Keying Wrong Transmitter

Since the DC level determines which transmitter is keyed and which transmitter receives a crewmembers audio, these levels must not overlap as a result of noise, ripple, and tolerances in voltage or resistance. The design presented in this section allows a minimum of one volt of "deadspace" between decision levels. Addition of a buffer to prevent loading will increase this "deadspace" to several volts. Thus, this does not appear to be a problem.

2. Minimum Wire Time Division Multiplexing

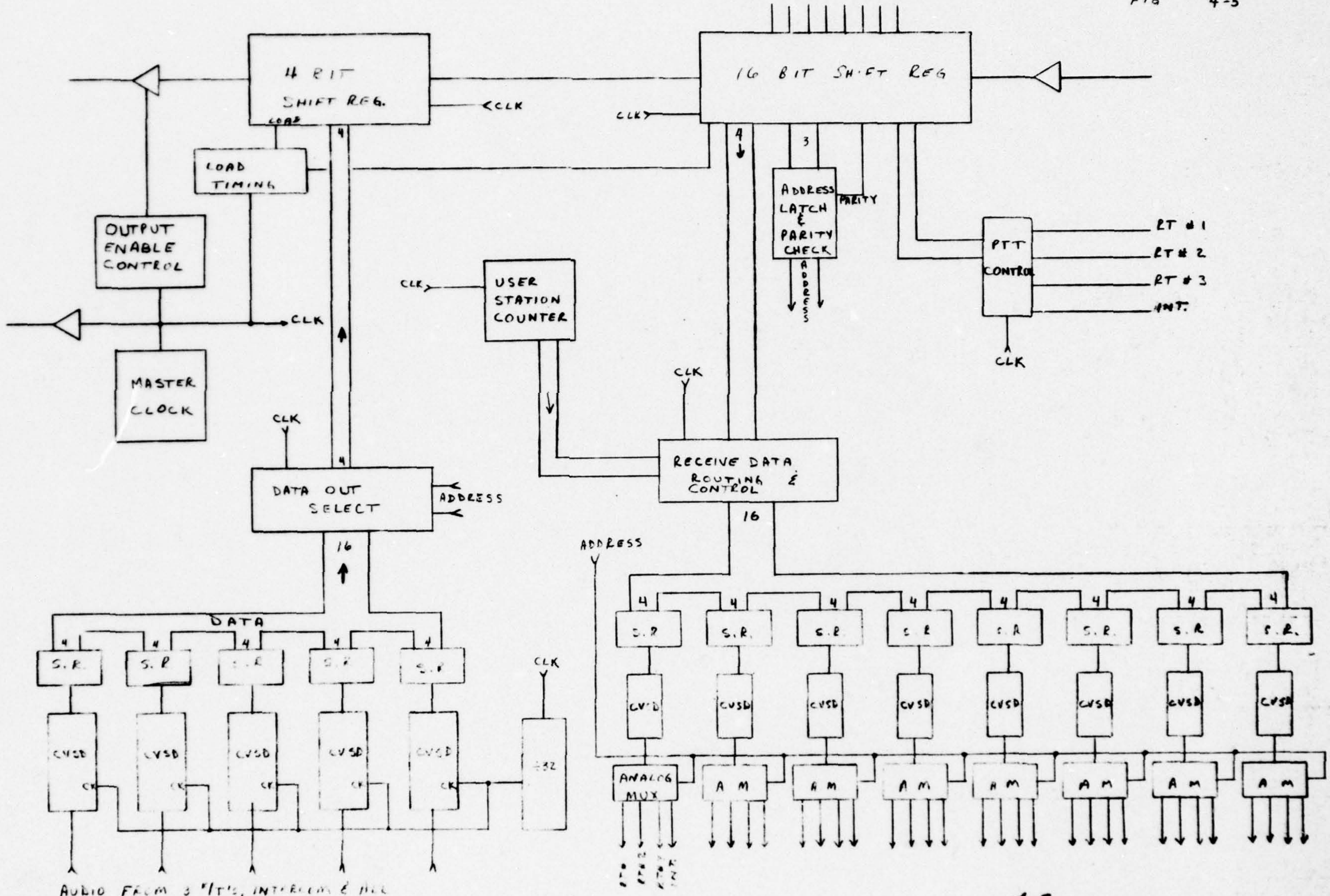
The heart of the TDMA (Time Division, Multiple Access) scheme is the Central Control unit. This unit provides timing and routing for the eight received signals from the user stations and the RT and intercom signals. An overall block diagram of the Central Control is shown in Figure 4-5. Each of the eight user stations is assigned an unique time slot in the data frame during which digitized transmit and receive audio is exchanged as well as routing and push-to-talk information. The format for this data is shown below.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
RCV Audio				Xmit Audio				Routing			Parity	PTT	

At the beginning of each frame will be either bits of synchronization data plus four bits to establish a guard band. Another four bit guard band is inserted at the end of each frame. The format for one entire frame containing 128 bits is shown below.

8	4	14	14	14	14	14	14	14	14	4
Sync	G. B.	User #1	#2	#3	#4	#5	#6	#7	#8	G. B.

CENTRAL CONTROL
FIG 4-5



Determination of the data rate and the system clock frequency is dictated primarily by the method used for audio data conversion. The approach under consideration is a commercially available single chip CVSD. This device is an encoder as well as a decoder, providing half duplex operation and is available optimized for 16 Kbps or 32 Kbps operation. From a systems viewpoint of noise, frequency response, and overall audio intelligibility, a CVSD operating at a data rate of 32 Kbps is indicated.

An effective and dependable sync detection scheme has not been determined as of this report. The actual sync pattern transmitted by Central Control is also undetermined. The sync pattern must be unique so that data patterns do not cause improper sync detection.

The sync detection circuit must accomplish several functions. It must, first of all, establish initial sync when system power is applied as well as when it is being plugged into an operating system. Secondly, it must block output data when any individual frame sync pattern is missed. Finally, it must re-establish sync as soon as possible after a missed sync.

Initial sync is established by a pattern recognition circuit that detects the sync pattern. A "window" is then established that encompasses the sync pattern and the surrounding four bit guard bands. As long as the sync pattern falls within this window, synchronization can be established. If the sync pattern is not detected within this window, the "window" can be opened slightly and N attempts are made at resync. If sync is not re-established in N frames, the initial sync circuit is enabled to re-establish sync.

Audio processing in the user stations is the same as that used in the Central Control. To ensure that the CVSD clock is in phase with the CVSD clock in the Central Control, frame sync is used as a prerequisite to releasing clock to the CVSD.

In order to provide uninterrupted audio to and from each of the eight user stations, as well as the RT's, the clock signal to the four bit shift registers must be 32 Kbps. To satisfy these timing requirements, the system clock must satisfy the following relationship:

$$\text{System clock} = (\text{\# of users}) \times (\text{\# bits/S.R.}) \times 32 \times 10^3$$

For eight user stations and four bit shift registers:

$$\text{System clock} = 8 \times 4 \times 32 \times 10^3 = 1.024 \text{ MHz}$$

Since the entire system timing is derived from this single source and the CVSD data clock is not critical, the clock frequency itself is not critical and may vary without significantly degrading system operation.

An overall block diagram of the user station is shown in Figure 4-6. Each of the user stations is assigned an unique fourteen bit block in the systems 128 bit frame by programming the relative lengths of the variable length shift registers. Once this has been done, the control timing is directly related to synchronization and the assigned frame position.

In the event that any of the user stations is not in sync with the system, provision must be made to prevent the out of sync station from putting data on the line outside of its assigned data block. This is accomplished by using a Tri-statable line driver at the output of the shift register. In its Tri-state condition, the output exhibits a high impedance and, therefore, does not affect the data line. A user station may put data on line only after frame sync is established.

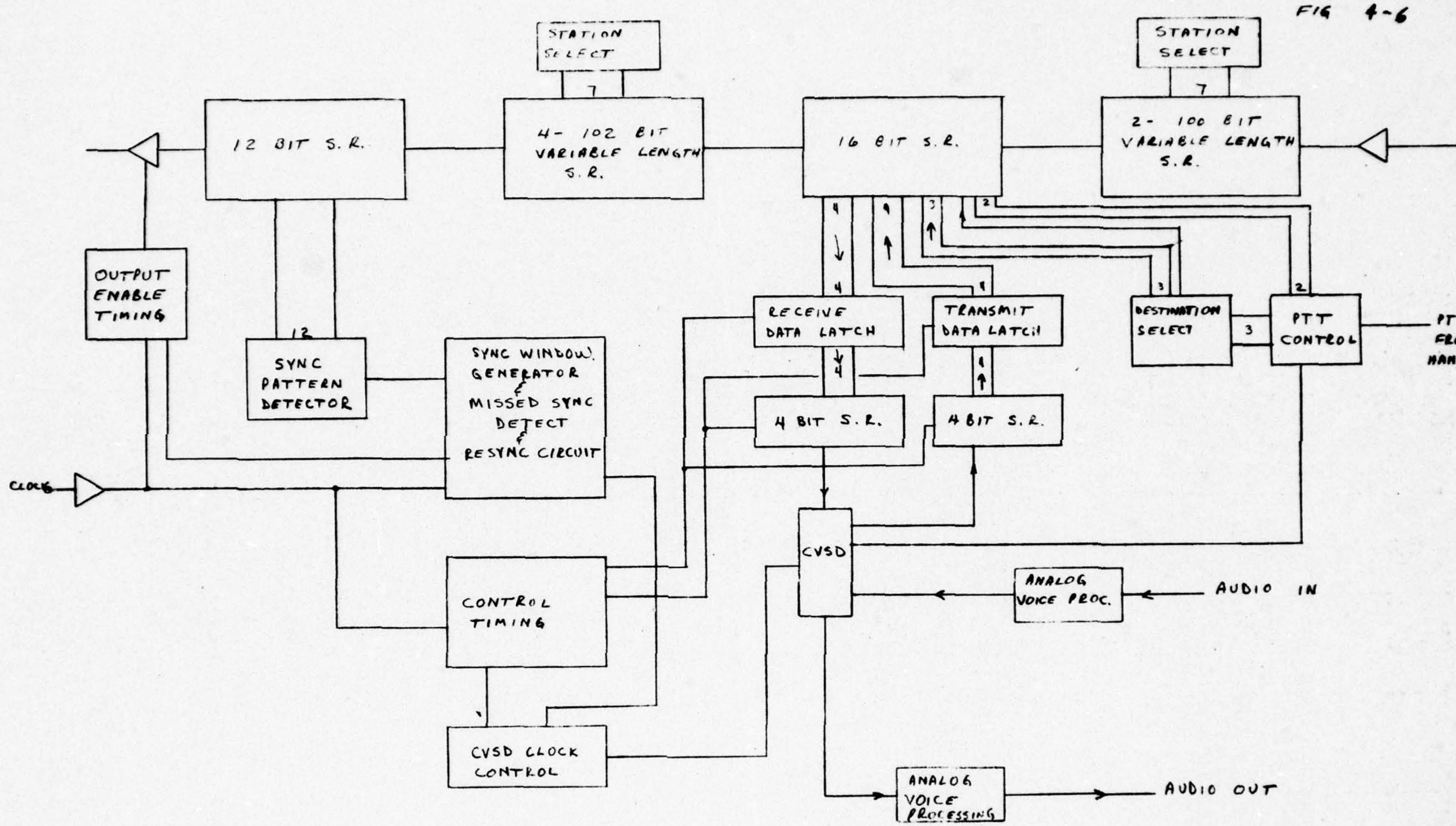
3. Totally Wireless Multiplexing Scheme

The concept of implementing a totally wireless TDMA system has been investigated and appears to be a non-cost effective approach. The advantage of total mobility of each crewmember is heavily outweighed by such factors as procurement cost, repair complexity, logistic supply, and difficulty in resolving certain EMI problems.

The initial procurement cost of a TDMA/wireless would be very high due to the complexity of the system. Figure 4-7 depicts the block diagram of a fully wireless TDMA system. The hardware required to implement this system includes six TDMA/RT units, a master control unit, and an outside station.

In order to appreciate the overall complexity of the system, let us look in detail at one part -- the TDMA/RT unit. Each TDMA/RT contains (see Figure 4-8) a receiver, transmitter, encoding/decoding and mode select circuitry. If we examine just the receiver and transmitter diagrams and keep in mind that a total eight of these units are required, the justification for not pursuing this effort in detail will be obvious. Figure 4-9 represents a conceptual block diagram of the receiver/transmitter unit. The implementation of this design would require several hybrid microcircuits of extreme complexity. The cost, therefore, to develop the low power, miniature full-duplex receiver/transmitter would be high due to the small physical size and required ruggedness. The unit production cost would also remain high for the same reasons.

USER STATION
FIG 4-6



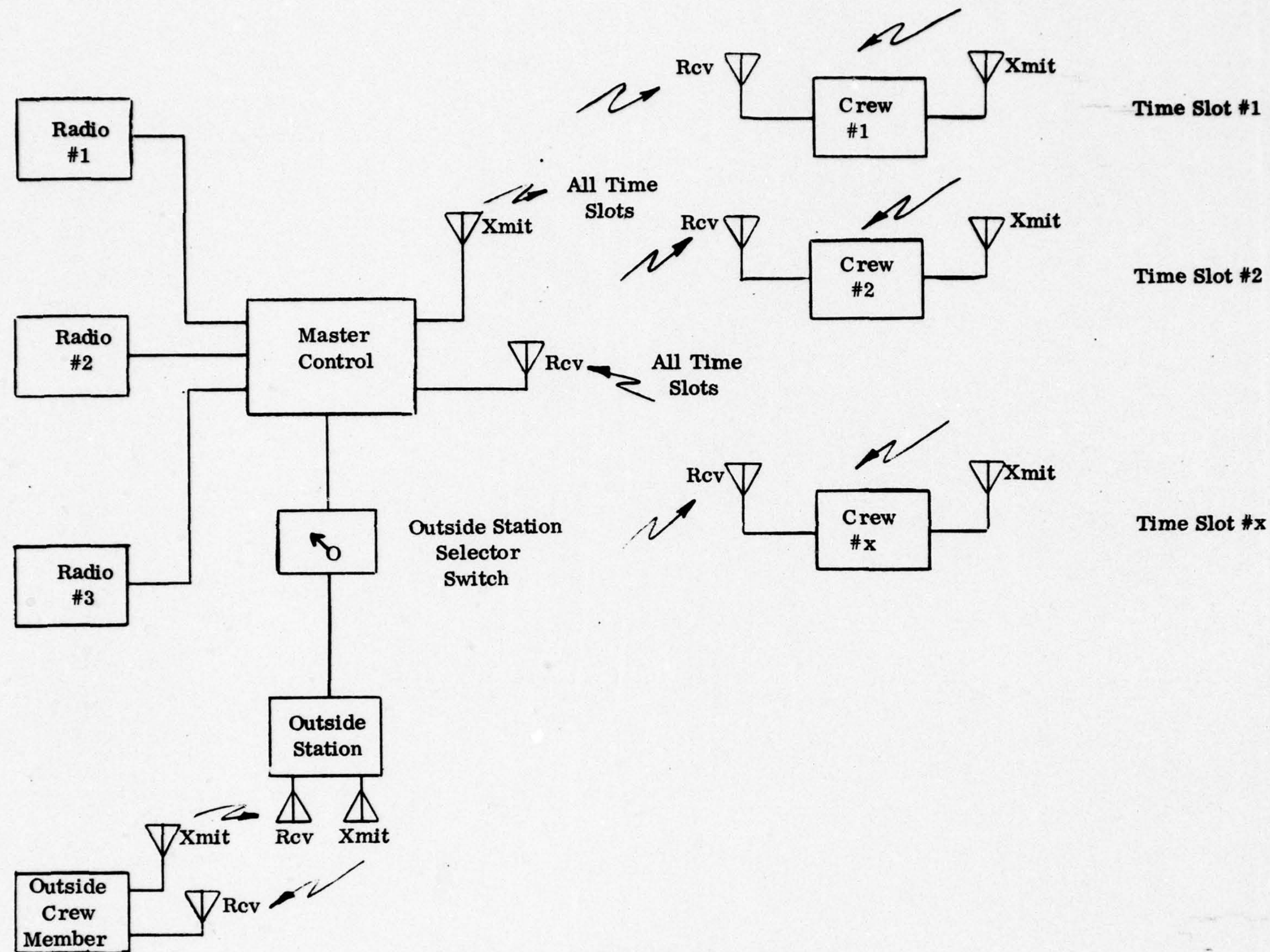


Figure 4-7. TDMA Wireless Diagram

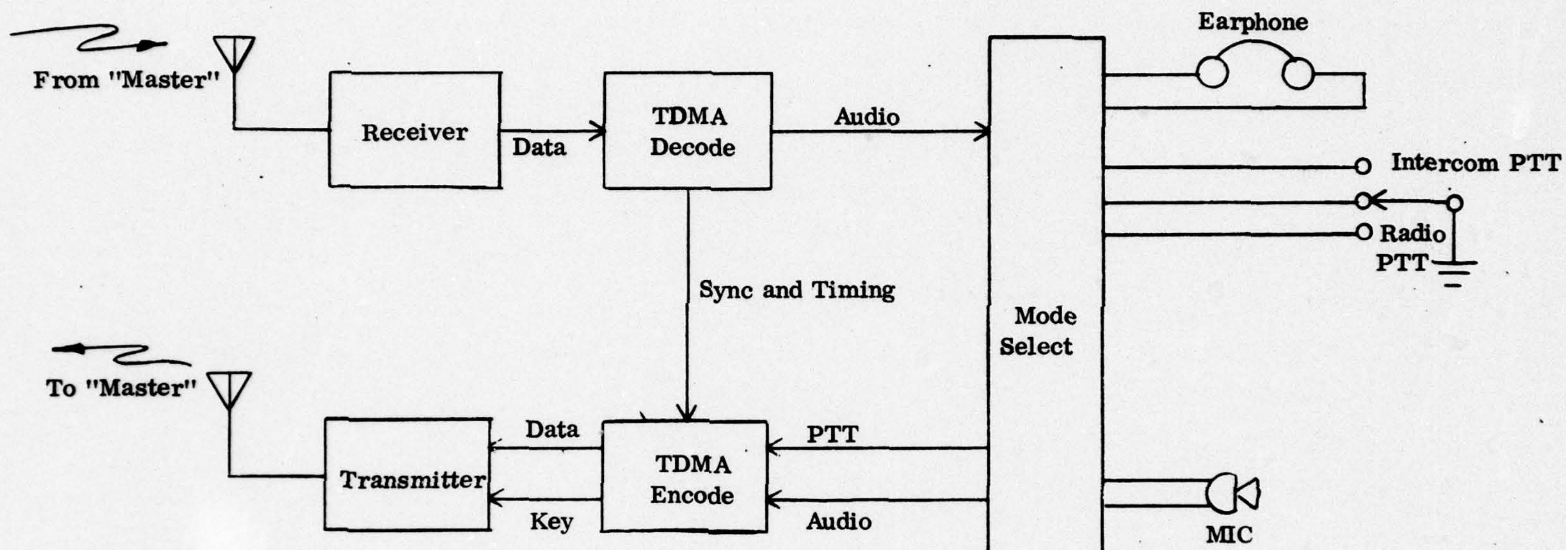


Figure 4-8. Crewmember TDMA R/T

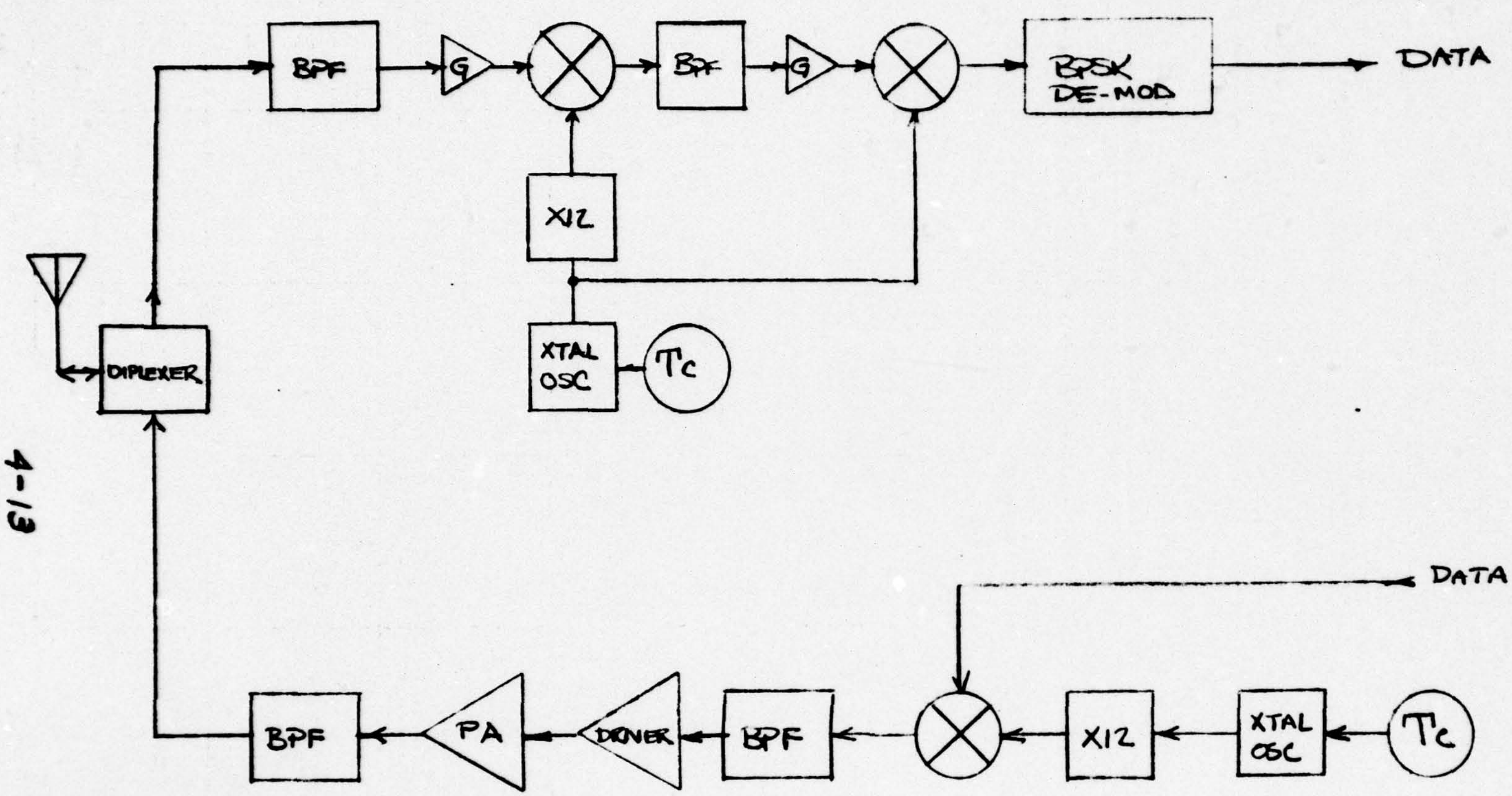


FIG 4-9
RECEIVER/TRANSMITTER
BLOCK DIAGRAM

The inherent circuit complexity of the binary PSK circuitry would require a high degree of skill to repair. The small package size and dense circuitry further complicates the repair effort.

The batteries required to operate the system could produce a difficult supply problem. Due to the power requirements, the time between charges on the battery would be relatively short necessitating a portable stock of charged batteries. Since the system fails when the batteries expire, a continuous supply of fresh batteries would be required.

The final major drawback in the TDMA/wireless approach is one of EMI. In the portable environment that the equipment would operate, it is impossible to guarantee that an EMI incompatibility could not exist. The frequency domains that are best suited to this application unfortunately are well suited for many applications and, therefore, are relatively crowded. As with the battery problem, any significant jammer could disable the entire system.

It is for the above mentioned considered that Cincinnati Electronics has decreased its study effort on the TDMA/wireless approach. The disadvantages are of significant severity as to justify no detail investigation into this technique. However, when the GEMM program is run for the other two approaches, parts list and other information could be submitted for this approach also to verify our position of not cost effective.

C. WIRELESS AUDIO ACCESSORY

1. Introduction (Figure 4-10)

To achieve wireless audio accessories as requested in the VIS specification, Cincinnati Electronics proposed use of VLF range frequencies and ultrasonic or inductive radiators. Use of low frequencies permit rapid attenuation and, thus TEMPEST protection in addition to advantages of not interfering with radio receivers used in the vehicles. Assuming the previously mentioned (in Section IV, B, 1) VCO to PLL concept works, receiver and transmitter design are simplified, thus providing ease of maintenance, low cost, and reliability.

1.1 Ultrasonic Radiators

A search is being made to find suitable ultrasonic radiators. Report of these devices will be present in the next Quarterly Report.

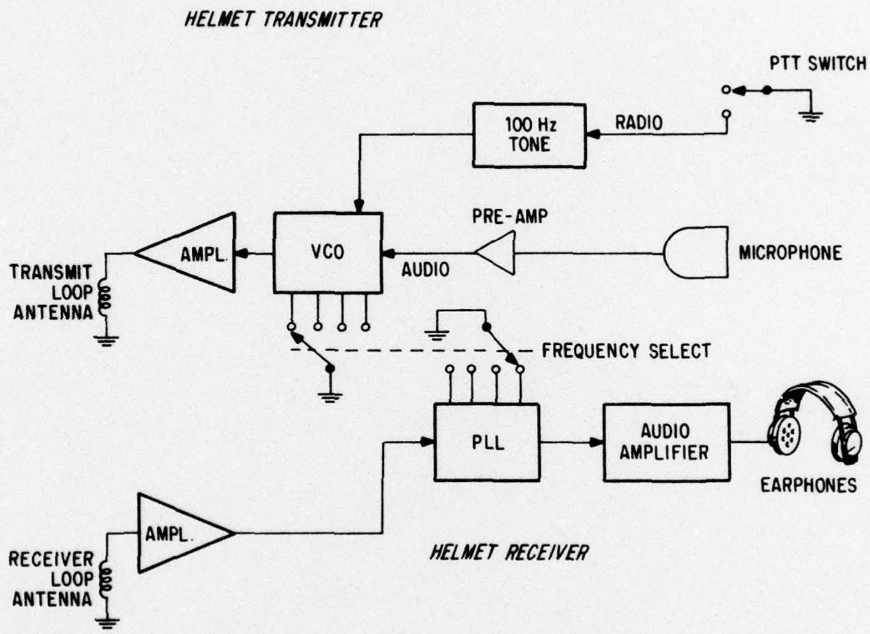


Figure 4-10. Wireless Audio Accessory

1.2 Inductive Radiators (Figure 4-11)

The theory behind inductive or H field radiation at low frequencies essentially is the same concept as a transformer. The radiator is one half of a transformer (the primary) and the receiver is the other half (the secondary). A voltage applied to the primary produces a current in the primary windings which, according to Faraday's Law, produces a magnetic field (flux) denoted by dashed lines. This magnetic field crosses the windings of the secondary; and, if the field varies with time, a current will be induced in the windings producing a voltage (V_2) at the secondary terminals. For a system shown in Figure 4-11, flux is attenuated by the reluctance of the air gap (resistance to the magnetic field due to the air gap separation between primary and secondary). Therefore, the intensity of the field is not as great in the secondary as compared to the primary; and, as a consequence, power loss occurs.

Theoretically, the radiator maximizes flux output when the current in its turns reaches maximum. Maximum current occurs at series resonance; and, therefore, a capacitor should be added to resonate with the inductance of the radiator's windings. This produces a sharp response at the resonant frequency which causes, unfortunately, a narrow bandwidth. Therefore, a resistor is needed to reduce the Q and increase the bandwidth. The resultant circuit is shown in Figure 4-12(A).

In the receiver, on the otherhand, it is desired to maximize voltage since the phase lock loop detects phase of the received voltage. Voltage is maximum at parallel resonance. Therefore, the receiver circuit is a parallel R-L-C resonant circuit. The resistance determines Q and bandwidth as in the radiator circuit (see Figure 4-12(B).

Breadboard measurements show that with the circuit configurations discussed, the receiver outputs about one and one-half millivolts (1.5 mv) into eighty-one thousand ohms (81 KΩ) at fifty kilohertz (50 kHz) with a separation of eight feet (8 feet). Attenuation occurred at the rate of sixteen decibels (16 dB) per octave of distance. Maximum distance cannot be determined since the phase lock loop has not been breadboarded as of this report.

APPLICATION	
NEXT ASSY	USED ON

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

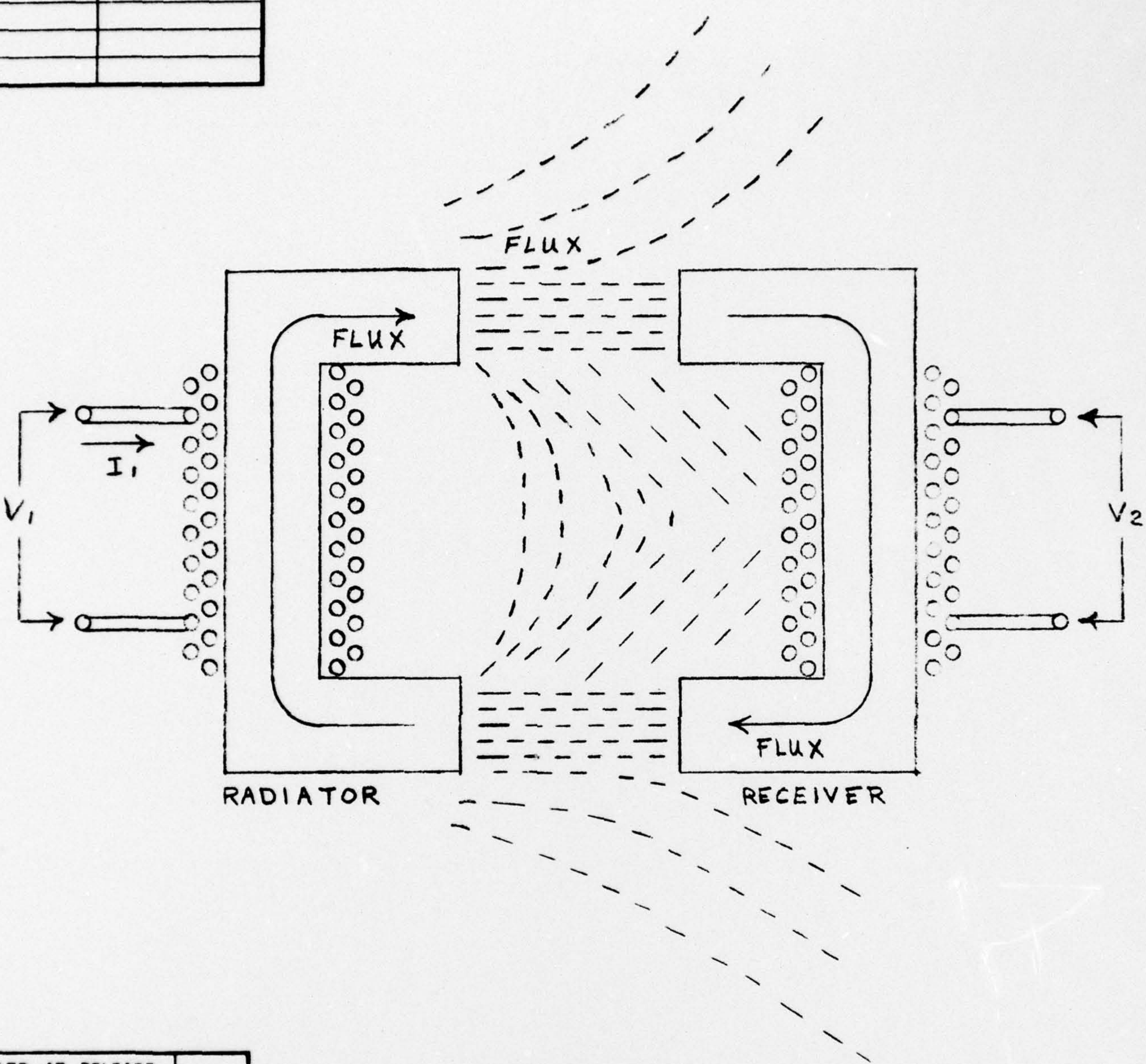


FIGURE 4-11

REV LTR AT RELEASE	
DATE OF ISSUE	
DOCUMENT STATUS	

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES.
TOLERANCES:
DECIMALS: .XX ±.02 .XXX ±.005
FRACTIONS: ±1/64 ANGLES: ±1/2°
INDUSTRY STANDARD TOLERANCES APPLY FOR GAUGE, TUBING, AND BAR STOCK.
DIMENSIONAL LIMITS APPLY BEFORE PAINTING AND AFTER PLATING.

MATERIAL:

PARTS AND/OR ASSEMBLIES MUST COMPLY WITH SPECIFICATION(S) NOTED HEREON. THE SPECIFICATION REVISION LETTER AND ISSUE DATE SHALL NOT BE EARLIER THAN THAT SPECIFIED ON EITHER THE APPLICABLE SPECIFICATIONS LIST OR PURCHASE ORDER.

CONTRACT NO.

DRAWN	DATE
CHECKED	DATE
APPROVED	DATE

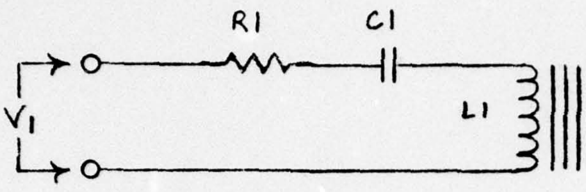
CINCINNATI ELECTRONICS CORP. CINCINNATI, OHIO

INDUCTIVE RADIATOR AND RECEIVER

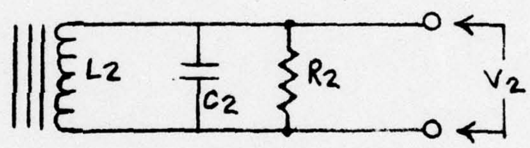
SIZE	CODE IDENT NO.	
A	80045	
SCALE		SHEET

APPLICATION	
NEXT ASSY	USED ON

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED



(A) RADIATOR CIRCUIT
SERIES RESONANT



(B) RECEIVER CIRCUIT
PARALLEL RESONANT

FIGURE 4-12

EV LTR AT RELEASE	
ATE OF ISSUE	
DOCUMENT STATUS	

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES.
TOLERANCES:
DECIMALS: .XX ±.02 .XXX ±.005
FRACTIONS: ±1/64 ANGLES: ±1/2°
INDUSTRY STANDARD TOLERANCES APPLY FOR GAUGE, TUBING, AND BAR STOCK.
DIMENSIONAL LIMITS APPLY BEFORE PAINTING AND AFTER PLATING.

MATERIAL:

ARTS AND/OR ASSEMBLIES MUST COMPLY WITH SPECIFICATION(S) NOTED HEREON. THE SPECIFICATION REVISION LETTER AND ISSUE DATE SHALL NOT BE EARLIER THAN THAT SPECIFIED ON EITHER THE APPLICABLE SPECIFICATIONS LIST OR PURCHASE ORDER.

CONTRACT NO.

DRAWN	DATE
CHECKED	DATE
APPROVED	DATE

CINCINNATI ELECTRONICS CORP CINCINNATI, OHIO

INDUCTIVE RADIATOR AND RECEIVER Schematic

SIZE	CODE IDENT NO.	
A	80045	
SCALE		SHEET

SECTION V

MEETINGS WITH GOVERNMENT

A. LSAP CONFERENCE HELD AT C.E., 20 OCTOBER 1977

The following areas concerning LSA, LSAM and LSA Plan were discussed with Bruce Ballance, USAECOM, during the LSAP Conference held on 20 October 1977.

1. LSA

LSA utilizing the LSAM (GEMM) will be used to quantitatively analyze the design approaches proposed that are feasible to meet the performance, usability and TEMPEST criteria. The feasible designs determined after the first 3-4 month period will be analyzed and a GEMM analysis performed to determine which design is the most cost effective to produce and maintain. This GEMM analysis will be documented for the draft submission (6 months) of the LSAM. The results of the GEMM analysis will be used as an input to the decision process in determining the design approach to pursue the remainder of the study. The final submission of the GEMM will be concerned with trade-off analysis and documentation of the final design approach.

2. LSAM

A copy of the "Generalized Electronics Maintenance Model" (GEMM), dated March 1975, was received from Mr. Ballance.

The type computer language of the GEMM Program and the possible problems of adapting the GEMM to C.E. Corp's computer were discussed. Mr. Zitsner, ILS Division, ECOM was telephoned, and he said the GEMM program was in Fortran IV language and that we should have no problem running it on our IBM 370. The GFE GEMM program deck is to be handcarried to Cincinnati Electronics by Mr. Newberry, Cincinnati Electronics Corp. Marketing.

The following information was obtained through our discussions:

1. Anticipated life of equipment is to be twenty (20) years.
2. The level of maintenance personnel performing maintenance will be MOS code 31B for Organizational and 31E for Direct Support and General support.
3. Maintenance Policy 7 of the "GEMM" will be used as the basic maintenance concept when evaluating design alternatives for LCC.

Mr. Ballance is supposed to supply the input Research and Development costs (card type 48) for the GEMM program.

3. LSA Plan

The LSA Plan submitted the proposal was discussed, and the following areas will be updated for the draft submission:

1. Expand paragraphs 4.3.3.2 and 4.3.3.3.2 to include specific detail of the analysis to be performed and the role of LSAM in the decision process.

2. Expand paragraph 4.3.1.1 to provide more detail of how the LSAM will be performed.

3. Update the LSA Program Schedule, Figure 4-3, of Draft Submission.

B. TECHNICAL APPROACH DISCUSSIONS 20 OCTOBER 1977

While the LSAP Conference was in progress, technical discussions were held with the COTR, Mr. Glenn William and Cincinnati Electronics Engineering personnel. As a result of this meeting, the following areas were identified as needing clarification from USAECOM.

1. TEMPEST philosophy relating to a wireless intercom link.

2. User inputs on type of PTT switch desired, outside box (C2296) function, positions requiring wireless and general information on intercom usage.

C. CONTRACTORS MEETING 17 NOVEMBER 1977 AT ECOM

TEMPEST philosophy and user problems were resolved at the 17 November 1977 meeting. Noise levels of the M113 APC were demonstrated and new types of microphones were presented.

D. CHANGE TO ECOM DEVELOPMENT SPECIFICATION DS-AF-0246A (A)

As a result of user information supplied at the 17 November 1977 meeting, the requirement for the external station was changed by DRSEL-PP-C-CS-3 (THI).

SECTION VI

PLANS FOR NEXT REPORT PERIOD

1. The selected National VCO and PLL will be breadboarded to simulate FDM Monitor Audio Approach.

2. Breadboard of one channel of TDMA should be completed during this period.

3. A TDMA sync detection scheme will be investigated.

4. One wireless link using VCO's and PLL's with magnetic radiators will be breadboarded.

5. Vendors of ultrasonic transducers and receivers will be contacted to obtain data sheets and samples.

6. Information required for the GEMM program will be generated if sufficient progress is made in the above mentioned areas. Otherwise this may not occur until early next report period.

DISTRIBUTION LIST

101 DEFENSE DOCUMENTATION CENTER
ATTN: DDC-TCA
CAMERON STATION (BLDG5)
*012 ALEXANDRIA, VA 22314

102 DIRECTOR
NATIONAL SECURITY AGENCY
ATTN: TDL
001 FORT GEORGE G. MEADE, MD 20755

103 CODE R123, TECH LIBRARY
DCA DEFENSE COMM ENGRG CTR
1860 WIEHLE AVE
001 RESTON, VA 22090

104 DEFENSE COMMUNICATIONS AGENCY
TECHNICAL LIBRARY CENTER
CODE 205 (P. A. TOLOVI)
001 WASHINGTON, DC 20305

200 OFFICE OF NAVAL RESEARCH
CODE 427
001 ARLINGTON, VA 22217

203 GIDEP ENGINEERING & SUPPORT DEPT
TE SECTION
PO BOX 398
001 NORCO, CA 91760

205 DIRECTOR
NAVAL RESEARCH LABORATORY
ATTN: CODE 2627
001 WASHINGTON, DC 20375

206 COMMANDER
NAVAL ELECTRONICS LABORATORY CENTER
ATTN: LIBRARY
001 SAN DIEGO, CA 92152

207 CDR, NAVAL SURFACE WEAPONS CENTER
WHITE OAK LABORATORY
ATTN: LIBRARY, CODE WX-21
001 SILVER SPRING, MD 20910

210 COMMANDANT, MARINE CORPS
HQ, US MARINE CORPS
ATTN: CODE LMC
002 WASHINGTON, DC 20380

211 HQ, US MARINE CORPS
ATTN: CODE INTS
001 WASHINGTON, DC 20380

212 COMMAND, CONTROL & COMMUNICATIONS DIV
DEVELOPMENT CENTER
MARINE CORPS DEVELOPMENT & EDUC COMD
001 QUANTICO, VA 22134

* Decrease to 2 copies if report is not releasable to public. See [illegible] for types of reports not to be sent to DDC

215 NAVAL TELLCOMMUNICATIONS COMMAND
TECHNICAL LIBRARY, CODE 91L
4401 MASSACHUSETTS AVENUE, NW
001 WASHINGTON, DC 20390

217 NAVAL AIR SYSTEMS COMMAND
CODE: AIR-5332
004 WASHINGTON, DC 20360

300 AUL/LSE 64-285
001 MAXWELL AFB, AL 36112

301 ROME AIR DEVELOPMENT CENTER
ATTN: DOCUMENTS LIBRARY (TILD)
001 GRIFFISS AFB, NY 13441

304 AIR FORCE GEOPHYSICS LAB
L. G. HANSCOM AFB
ATTN: LIR
001 BEDFORD, MA 01730

307 HQ ESD (DRI)
L. G. HANSCOM AFB
001 BEDFORD, MA 01731

310 HQ, AFCS
ATTN: EPECRW MAIL STOP 105B
001 RICHARDS-GEBAUR AFB, MO 64030

312 HQ, AIR FORCE ELECTRONIC WARFARE CENTER
ATTN: SURP
002 SAN ANTONIO, TX 78243

314 HQ, AIR FORCE SYSTEMS COMMAND
ATTN: DLCA
ANDREWS AFB
001 WASHINGTON, DC 20331

403 CDR, MIRCOM
REDSTONE SCIENTIFIC INFO CENTER
ATTN: CHIEF, DOCUMENT SECTION
001 REDSTONE ARSENAL, AL 35809

406 COMMANDANT
US ARMY AVIATION CENTER
ATTN: ATZQ-D-MA
003 FORT RUCKER, AL 36362

408 COMMANDANT
US ARMY MILITARY POLICE SCHOOL
ATTN: ATSJ-CD-M-C
003 FORT MCCLELLAN, AL 36201

417 COMMANDER
US ARMY INTELLIGENCE CENTER & SCHOOL
ATTN: ATSI-CD-MD
002 FORT HUACHUCA, AZ 85613

418 COMMANDER
HQ FORT HUACHUCA
ATTN: TECHNICAL REFERENCE DIV
001 FORT HUACHUCA, AZ 85613

419 COMMANDER
US ARMY ELECTRONIC PROVING GROUND
ATTN: STEEP-MT
002 FORT HUACHUCA, AZ 85613

420 COMMANDER
USASA TEST & EVALUATION CENTER
ATTN: IAO-CDR-T
001 FORT HUACHUCA, AZ 85613

432 DIR, US ARMY AIR MOBILITY R&D LAB
ATTN: T. GOSSETT, BLDG 207-5
NASA AMES RESEARCH CENTER
001 MOFFETT FIELD, CA 94035

436 HQDA(DAMO-TCE)
002 WASHINGTON, DC 20310

437 DEPUTY FOR SCIENCE & TECHNOLOGY
OFFICE, ASSIST SEC ARMY (R&D)
001 WASHINGTON, DC 20310

438 HQDA(DAMA-ARP/DR. F. D. VERDERAME)
001 WASHINGTON, DC 20310

470 DIRECTOR OF COMBAT DEVELOPMENTS
US ARMY ARMOR CENTER
ATTN: ATZK-CD-MS
002 FORT KNOX, KY 40121

473 COMMANDANT
US ARMY ORDNANCE SCHOOL
ATTN: ATSL-CD-OR
002 ABERDEEN PROVING GROUND, MD 21005

475 CDR, HARRY DIAMOND LABORATORIES
ATTN: LIBRARY
2800 POWDER MILL ROAD
001 ADELPHI, MD 20783

477 DIRECTOR
US ARMY BALLISTIC RESEARCH LABS
ATTN: DRXBR-LB
001 ABERDEEN PROVING GROUND, MD 21005

478 DIRECTOR
US ARMY BALLISTIC RESEARCH LABS
ATTN: DRXBR-CA (DR. L. VANDEKIEFT)
001 ABERDEEN PROVING GROUND, MD 21005

479 DIRECTOR
US ARMY HUMAN ENGINEERING LABS
001 ABERDEEN PROVING GROUND, MD 21005

482 DIRECTOR
US ARMY MATERIEL SYSTEMS ANALYSIS ACTY
ATTN: DRXSY-T
001 ABERDEEN PROVING GROUND, MD 21005

507 CDR, AVRADCOM
ATTN: DRSAV-E
PO BOX 209
001 ST. LOUIS, MO 63166

512 COMMANDER
PICATINNY ARSENAL
ATTN: SARPA-ND-A-4 (BLDG 95)
001 DOVER, NJ 07801

514 DIRECTOR
JOINT COMM OFFICE (TRI-TAC)
ATTN: TT-AD(TECH DOCU CEN)
001 FORT MONMOUTH, NJ 07703

515 PROJECT MANAGER, REMBASS
ATTN: DRCPM-RBS
002 FORT MONMOUTH, NJ 07703

516 PROJECT MANAGER, NAVCON
ATTN: DRCPM-NC-TM
BLDG 2539
001 FORT MONMOUTH, NJ 07703

517 COMMANDER
US ARMY SATELLITE COMMUNICATIONS AGCY
ATTN: DRCPM-SC-3
002 FORT MONMOUTH, NJ 07703

518 TRI-TAC OFFICE
ATTN: TT-SE
001 FORT MONMOUTH, NJ 07703

531 CDR, US ARMY RESEARCH OFFICE
ATTN: DRXRO-IP
PO BOX 12211
001 RESEARCH TRIANGLE PARK, NC 27709

533 COMMANDANT
US ARMY INST FOR MILITARY ASSISTANCE
ATTN: ATSU-CTD-MO
001 FORT BRAGG, NC 28307

536 COMMANDER
US ARMY ARCTIC TEST CENTER
ATTN: STEAC-TD-MI
002 APO SEATTLE 98733

537 CDR, US ARMY TROPIC TEST CENTER
ATTN: STETC-MO-A (TECH LIBRARY)
DRAWER 942
001 FORT CLAYTON, CANAL ZONE 09827

542 COMMANDANT
US ARMY FIELD ARTILLERY SCHOOL
ATTN: ATSFA-CTD
002 FORT SILL, OK 73503

519 CDR. US Army Avionics Laboratory
AVRADCOM
ATTN: DAVAA-D
001 Fort Monmouth, NJ 07703

554 COMMANDANT
US ARMY AIR DEFENSE SCHOOL
ATTN: ATSA-CD-MC
001 FORT BLISS, TX 79916

555 COMMANDER
US ARMY NUCLEAR AGENCY
001 FORT BLISS, TX 79916

563 COMMANDER, DARCOM
ATTN: DRCDE
5001 EISENHOWER AVE
001 ALEXANDRIA, VA 22333

564 CDR, US ARMY SIGNALS WARFARE LABORATORY
ATTN: DELSW-OS
ARLINGTON HALL STATION
001 ARLINGTON, VA 22212

566 CDR, US ARMY SIGNALS WARFARE LABORATORY
ATTN: DELSW-AQ
ARLINGTON HALL STATION
001 ARLINGTON, VA 22212

572 COMMANDER
US ARMY LOGISTICS CENTER
ATTN: ATCL-MC
002 FORT LEE, VA 22801

575 COMMANDER
US ARMY TRAINING & DOCTRINE COMMAND
ATTN: ATCD-TEC
001 FORT MONROE, VA 23651

577 COMMANDER
US ARMY TRAINING & DOCTRINE COMMAND
ATTN: ATCD-TM
001 FORT MONROE, VA 23651

578 CDR, US ARMY GARRISON
VINT HILL FARMS STATION
ATTN: IAVAAF
001 WARRENTON, VA 22186

602 DIRECTOR, NIGHT VISION LABORATORY
US ARMY ELECTRONICS COMMAND
ATTN: DRSEL-NV-D
001 FORT BELVOIR, VA 22060

603 CDR/DIR, ATMOSPHERIC SCIENCES LABORATORY
US ARMY ELECTRONICS COMMAND
ATTN: DRSEL-BL-SY-S
001 WHITE SANDS MISSILE RANGE, NM 88002

605 CHIEF, AVIATION ELECTRONICS DIV (SIMO)
US ARMY ELECTRONICS COMMAND
ATTN: DRSEL-SI-AE, PO BOX 209
001 ST. LOUIS, MO 63166

606 CHIEF
INTEL MATERIEL DEV & SUPPORT OFC
ELECTRONIC WARFARE LAB, ECOM
001 FORT MEADE, MD 20755

681 CDR, US ARMY COMMUNICATIONS
RESEARCH AND DEVELOPMENT COMMAND
FORT MONMOUTH, NJ 07703

10 PM SINCGARS
DRCPM-GARS-LM

42 DRDCO-COM-RN-3

701 MIT - LINCOLN LABORATORY
ATTN: LIBRARY (RM A-082)
PO BOX 73
002 LEXINGTON, MA 02173

703 NASA SCIENTIFIC & TECH INFO FACILITY
BALTIMORE/WASHINGTON INTL AIRPORT
001 PO BOX 8757, MD 21240

682 Cdr, CERCOM
ATTN: DRSEL-MS-TI
FORT MONMOUTH, NJ 07703 2 cys

680 Cdr, ERADCOM
ATTN: DELSD-L
FORT MONMOUTH, NJ 07703 1 cy